
Novel Tools, Classic Techniques: Evolutionary Studies Using Primate Pluripotent Stem Cells.

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Funding Grants: Developing a drug-screening system for Autism Spectrum Disorders using human neurons

Public Summary:

This is a critical review of the stem cell field using iPSC technology to model human disease and for evolutionary studies. Here, we argue that the use of reprogramming techniques could bring unexpected insights into neurodevelopmental human disorders.

Scientific Abstract:

Recent applications of genomic tools on the analysis of alterations unique to our species coupled with a growing number of neuroanatomical studies across primates provide an unprecedented opportunity to compile different levels of human brain evolution into a complex whole. Applications of induced pluripotent stem cell (iPSC) technology, capable of reprogramming somatic tissue of different species and generating species-specific neuronal phenotypes, for the first time offer an opportunity to test specific evolutionary hypotheses in a field of inquiry that has been long plagued by the limited availability of research specimens. In this review, we will focus specifically on the experimental role of iPSC technology as applied to the analysis of neocortical pyramidal neurons. Pyramidal neurons emerge as particularly suitable for testing evolutionary scenarios, since they form the most common morphological class of neurons in the cortex, display morphological variations across different cortical areas and cortical layers that appear species-specific, and express unique molecular signatures. Human and nonhuman primate iPSC-derived neurons may represent a unique biological resource to elucidate the phenotypic differences between humans and other hominids. As the typical morphology of pyramidal neurons tends to be compromised in neurological disorders, application of iPSC technology to the analysis of pyramidal neurons could not only bring new insights into human adaptation but also offer opportunities to link biomedical research with studies of the origins of the human species.

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